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These experiments for the artificial extension of the white-fungus disease having been thus successful, I am anxious to keep the germs of the disease alive in my laboratory continuously, so that I may be able to continue the experiment during the coming season. In order that the vitality of these germs may be more certainly preserved, I desire to obtain constant supplies of live chinch-bugs for the purpose of communicating the disease to fresh material during the winter and spring. I therefore respectfully request those interested in these experiments to furnish the desired material. It is a difficult matter to find any live bugs in Douglas county, and the farmers of the State will without doubt willingly coöperate with the writer in continuing an investigation which promises to secure to them results of great practical value.

WHO SOLD HIS WHEAT FOR \$1.40?—OR AN EXAMINATION OF THE VALUE OF BLAKE'S TABLES.

BY GEO. E. CURTIS,* WASHINGTON, D. C.

In the fall of 1888 a copy of *Blake's Tables of Weather Predictions for 1889*† fell into my hands, and I was so much interested in the pamphlet in view of the considerable attention that it was receiving, that I began a review of its contents. But engagement in other duties interfered with the completion of this review, and my further attention was diverted from the subject until I recently read in the *Kansas Farmer* that "Prof. Blake is having an extensive sale for his Annual of Weather Predictions for 1890." The present time, therefore, seems to be especially opportune for making an impartial examination of the "Tables" for 1889. For, if Mr. Blake's long-range predictions have been strikingly fulfilled, the fact would furnish some ground for purchasing his "Tables" for 1890, and for following his advice as to early or late planting, the character of crop to put in, and the time to sell grain. But if, on the other hand, his most important and most confidently emphasized predictions have entirely failed, assuredly Kansas farmers will wish to know this in order to escape following blind leaders of the blind. Manifestly, therefore, the most rational thing to do is to make such an examination of the "Tables" as will enable us to determine their claim to our attention. In common with all professional meteorologists with whom I am acquainted, I am ready to welcome any more powerful methods of weather prediction than are now known to the scientific world; but for some reason Mr. Blake has not seen fit to publish the detailed methods that he has employed in calculating his "Tables," and he has given only vague references to "four large account books filled with formulas and figures," and to the discovery of a mysterious "universal law of axial rotation," which has been the "stepping-stone" to his success.

If these discoveries are genuine astronomical or physical laws, then the highest honors would follow their publication, and hence the present secrecy justly but unfortunately throws upon them a suspicion which they ought not to pre-deserve. In lieu, therefore, of studying the methods by which the "Tables" were constructed, there remains only to determine their success, by comparing the predicted with the actual weather; and it is to such a comparison that I invite all who are yet uncertain as to whether in the present state of knowledge they do well to trust in any long-range predictions.

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† Blake's Tables of Weather Predictions for each State for each month of 1889, according to mathematical calculations based on astronomical laws: C. C. Blake, Topeka, Kansas.

The "Tables" consist primarily in tabulated temperatures and monthly rainfalls predicted for each State. But in addition to these, and by their aid, Mr. Blake has in a running commentary interpreted the figures, and with more or less definiteness described what would be the main characteristics of the different seasons. Such of these predictions as are expressed unconditionally are here given:

1. "In January, 1889, there will be considerable steady cold weather, with a good deal of snow, which will drift badly, probably causing numerous railroad blockades; the mean temperature will be a trifle *below* normal."

2. "The precipitation is to be large in January in most of the country, and much heavier than usual in the Northwestern States."

3. "On the Pacific coast the rains will continue much later in the spring than usual."

4. "In the western third of the State [Kansas] we think all crops should be planted as soon as the cold snap is over in April. There will be no more cold weather after that severe spell in April." Minimum temperature in April in eastern half of Kansas will be 17°, mean temperature will be 50°, five degrees below the average.

5. "We calculate that the summer will be a hot one in the Northern States. . . . The temperature will be very hot in July and August in most every part of the country."

6. "We are quite confident that there will be no hot winds in Kansas before the middle of August."

7. "The unprecedented drouth of 1889." "Such a drouth as that of next summer will search out every nook and corner, scarcely leaving any green thing in large parts of the country."

"As will be seen by an inspection of the Tables, such will be the fate of most of the Northern States next summer."

"We gave ample warning of the drouths of 1886 and 1887, and now give warning of the still greater drouth of 1889."

"In Ohio and Michigan . . . the drouth will start in April and continue without a break till the crop season is virtually over."

NEW ENGLAND AND MIDDLE ATLANTIC STATES: "In these States the drouth will generally commence in June and be very severe in August and September."

"In the Eastern States, as a rule, the drouth will be very severe."

"Would that we were able to avert the horrors of the eastern, western and northern sheol of 1889."

8. "There will be very heavy rains in the Ohio valley in August and September, amounting to floods in some places. . . . It will be too late then to make a crop."

9. "There will be enough rain in a large part of Kansas to raise an immense crop of corn if it is well put in on time, and thoroughly tended. In most of Kansas it will be very favorable for potatoes, as well as most other crops."

10. "East of the Rocky Mountains it will generally be too dry for that crop [potatoes] in the Northern States, and in part of the Southern States it will be too wet."

11. "Next year there will be frosts in September, but none in August in the spring-wheat regions."

12. "When wheat was selling for 80 cents at Chicago last summer, and we advised our readers to sow a large crop of wheat in Kansas, telling them that it would be worth \$1.40 at Chicago next July, we were thought by some to be wild. But when our readers inspect all the weather tables herein, they will not think our table of prices is so very wild as it seems to be."

TABLE OF PRICES OF NO. 2 SPRING WHEAT FOR 1889.

<i>Date.</i>	<i>Predicted by Blake.</i>	<i>Actual market.</i>
January 31, 1889.....	\$1 34	\$0 94½ @ \$0 95½
February 28, 1889.....	1 52	1 03½ @ 1 04½
March 30, 1889.....	1 50	1 00 @ 1 01
April 30, 1889.....	1 85	81 @ 82
May 31, 1889.....	1 87	77½ @ 78
June 29, 1889.....	2 30	81 @ 82
July 31, 1889.....	1 72	78 @
August 31, 1889.....	1 74	77 @ 77½

13. "The northern corn crop will mostly be a failure, and prices will be high a year from now."

14. "As will be seen by the table, the west third of Kansas will be deficient in rain after June."

The preceding extracts comprise the principal predictions made by Mr. Blake as deductions from his "Tables." And because a comparison of all his tables with the actual temperatures and pressures would be too great a labor, and since any selection by me of a portion of them might not fairly represent the whole, it seems best to confine the verification to Mr. Blake's own selection from the tables and his predictions based thereon.

The data used in the work have been obtained from the United States Bureau of Statistics, the Department of Agriculture, the Reports of the State Weather Services, and the Weekly Crop Bulletin and Monthly Weather Review of the Signal Service ; and I am under obligation to the officers of these various Bureaus for their kind assistance in furnishing me the necessary material.

ACTUAL WEATHER.

1. "As a whole the snow-falls of January, 1889, have been *unusually small*." "The mean temperature was generally *above* the normal over all districts east of the Rocky Mountain regions, except in portions of Florida and Texas."—*Monthly Weather Review*.

In Dakota and Minnesota, where the predicted "steady cold weather" would naturally be expected to occur, the mean temperature was from 10° to 15° above the normal.

2. To test the value of the special prediction of heavy precipitation in the Northwestern States, the following table has been prepared, giving Mr. Blake's predicted precipitation, the normal precipitation for January, and the actual precipitation.

PRECIPITATION IN NORTHWESTERN STATES.

<i>Location.</i>	<i>January normal. (Given by Blake.)</i>	<i>Predicted amount for January, 1889.</i>	<i>Actual amount for January, 1889.</i>
Wisconsin.....	1.65	4.52	2.30
Iowa.....	1.05	4.97	Normal.
South Minnesota.....	0.87	3.23 }	1.00
North Minnesota.....	0.70	2.67 }	
East Dakota.....	0.40	2.75 }	0.80
West Dakota.....	0.76	2.56 }	
East Nebraska.....	0.74	4.08	1.50
Middle Nebraska.....	0.65	3.16	.30 to 1.40, av. 1.
West Nebraska.....	0.40	1.42	Below normal.

3. To determine the degree of verification of the third prediction, the following statements as to the precipitation on the Pacific coast for April, May and June have been taken from the *Monthly Weather Review*:

"In April, 1889, the precipitation over the whole Pacific coast was *below* the nor-

mal, the most marked deficiency occurring on the South Pacific coast, where the average rainfall amounted to but 16 per cent. of the normal for the month. In the other districts the percentages of the normal were: Middle Pacific coast, 45 per cent.; North Pacific coast, 89 per cent."

"For May the average rainfall on the North Pacific coast was 2.9 inches, being .1 inch above the normal; on the Middle Pacific coast the rainfall was 2.5 inches, being 1.8 inches above the normal; and over the South Pacific region the rainfall was .34 inch, being .05 inch below the normal."

"In June the precipitation over the whole Pacific coast was below the normal, over the North and South Pacific being only one-half the average, and over the Middle Pacific being 86 per cent."

From these figures it may be considered that, of the three divisions into which the Pacific coast is divided, Mr. Blake's prediction was fulfilled in one—the Middle Pacific—and failed in the other two.

4. That there will be a "cold spell" sometime in April, *i. e.*, that a period of colder weather than the average will follow a period of warm weather, is about as certain as that there will be April showers, or snow in February. The fourth prediction, therefore, may be taken simply as a cautionary warning that is always applicable, or it may be meant to predict a cold spell of extraordinary severity.

The actual weather was as follows:

The lowest temperature in the State was 23° at Topeka, on one day. Prof. Snow, of Lawrence, states that his lowest temperature was 35°; that a light frost did no damage to peach buds; and that the weather throughout the month was highly favorable to crops.

Of 13 stations in eastern Kansas, five, and of 44 stations in middle and western Kansas only one-quarter, had any weather below freezing. The mean temperature for eastern Kansas, as well as for the whole State, was above the normal. The Bulletin of the Kansas Weather Service for May 4th reports "the preceding week a cold one for the season, with frosts in all but southeast counties; weather favorable for wheat, rye and oats, but too cold for corn and garden vegetables."

From these different statements it will be seen that if the prediction be taken to mean a "cold snap" of more than usual severity, as seems to be indicated by its prominence and by the 17° predicted for eastern Kansas, it was not a marked success. But if it be considered to mean *any* cold wave, then it was completely fulfilled, and Mr. Blake is entitled to all the credit which can be derived from it. In this case the prediction is without question a valuable one, but it exhibits a good knowledge of past weather rather than any special foreknowledge of the future.

5. From the *Monthly Weather Review* for July, I find that the temperature throughout the country east of the Rocky Mountains was either about normal or below normal, and for August the data at hand indicate that in general the summer east of the Mississippi was *cool*, and west of the Mississippi *warm or hot*. This prediction, therefore, is in the main unverified.

6. Hot winds prevailed in Kansas on the 5th, 6th, 7th, 26th, 27th and 28th of July.—*State Weather Service*.

"Wallace: Hot winds in fore part of August ruined corn in some sections."—*Report on Condition of Crops, Department of Agriculture*.

7. Of all the predictions made for 1889, no others are so often repeated and so strongly emphasized as the prediction of an extraordinary summer drouth; and the extracts that have been above given show the confidence with which the prediction was made, and the importance which the author attached to it. This prediction may therefore be considered to be pivotal in its character, and to contain a crucial test of the whole system upon which the tables are constructed. Moreover, because of

its unusual character the chance of accidental verification is small, and therefore a fulfillment would be the more striking and convincing. To give an account of the actual weather as contrasted with this prediction is an undertaking for which there is here no space. But for descriptions of the unprecedented rains, the disastrous floods, the extraordinary cloud-bursts, destructive washouts, bursting reservoirs and broken dams, of which the Johnstown calamity was the culmination but not the end, the reader has only to refer to the newspaper files from April to August, and to read the overflowing pages of the *Monthly Weather Reviews* for the same period. The reports of drouth, which in other years have generally occupied three columns of the *Weather Review* for the spring and summer months, have been diminished to a few paragraphs; and in midsummer (July) the only reports of drouth published are from the arid regions of Utah, Montana, and Nevada.

8. No reports of these predicted heavy August and September rains have been found.

9. Fully verified.

10. For Northern States not verified; for Southern States the crop is so unimportant that the crop bulletin of the Agricultural Department does not report it, but the prediction is quite safe, and has no doubt been fulfilled.

11. Verified; but the remarks appended to the discussion of No. 4 are in a measure applicable to this.

12. The actual prices have been placed for comparison in the above table with the predicted prices. No further comment is necessary.

13. The estimated corn crop made by the September Crop Report is 91 per cent.

14. The following table contains the predicted and the actual precipitation in Kansas from May to August, inclusive:

SUMMER PRECIPITATION IN KANSAS.

1889.	Divisions of State.	Predicted.	Actual.
May.....	{ Western.....	2.80	3.10
	{ Middle.....	3.50	5.90
	{ Eastern.....	4.50	7.40
June.....	{ Western.....	1.80	3.35
	{ Middle.....	3.56	3.90
	{ Eastern.....	3.60	4.80
July.....	{ Western.....	0.53	2.80
	{ Middle.....	2.83	5.00
	{ Eastern.....	1.75	6.20
August.....	{ Western.....	0.63	2.63
	{ North Middle.....	0.90	2.30
	{ South Middle.....	4.10	2.90
	{ Eastern.....	2.10	3.35

For December, 1889: The average precipitation was to be one inch and eighty-one hundredths (1.81) for Kansas; the records of the Kansas Weather Service observers show an average for the State of about four-hundredths (.04) of an inch. The average temperature for the State for December was to be 14°. The above-mentioned records put it above 40°; all reports stating that it has been the warmest and driest December for the State on their records. The Government Bulletin says: "The month of December has been unusually warm in all districts east of the Rocky Mountains, while the normal temperature prevailed on the California Coast, and it has been slightly cooler than usual on the North Pacific Coast."

—The preceding comparisons of the predicted with the actual weather are sufficient for the purpose. What conclusion has been forced upon the reader? what are we to say about them as a whole?—for it is as a whole that they must stand or fall. Although desirous of finding and ready to welcome a real advance in predict-

ive meteorology, I state candidly, that although we have found a few verifications, yet the predictions as a whole seem to me to afford a poor showing. The present year has exhibited most striking and well-defined characteristics, and thereby has afforded a particularly good opportunity for one who with a true method should essay to predict its peculiarities. The winter throughout the country was generally mild. The spring and early summer east of the Mississippi river were characterized by almost unprecedented rains and floods, producing wide-spread ravages, and injuring or ruining many crops. In the northwestern territories of the arid region, on the other hand—Utah, Idaho, and Montana—a continued drouth has prevailed, and all vegetation has succumbed. In the Dakotas the rainfall has been very small, but still in many portions very good crops will be secured.

I submit that a weather prophet could scarcely have failed more signally in determining the marked characteristics of the seasons than has Mr. Blake with his cold winter, his hot summer, and his unprecedented drouth in the Northern States extending from the Atlantic seaboard to the Rocky Mountains, Kansas excepted. Instead of a cold winter, there was a mild winter; instead of a hot summer, the temperature has in general been below the average in Kansas and east of the Mississippi river; and instead of an unprecedented drouth, there have been east of the Mississippi river most extraordinary rains. The price of wheat, which was to have risen to \$1.40 in July, has remained persistently low, and the Kansas farmers who held for a rise have seen the price steadily decline under the prospects of a magnificent crop.

In view of all this experience, the hard-working Kansas farmer will be too hard-headed to trust to weather tables "based on astronomical mathematics" which the author fails to publish to the world. Scientific men obtain their laurels by the fullest publication of their work; and one who refuses to make such publication deserves no following, for this of itself is *prima facie* evidence of presumption or fraud.

For the man who really accomplishes what Mr. Blake pretends, there awaits a position of power, a seat of honor, and the laurel wreath of fame. Science and industry will unite in placing on his head an imperishable crown, and the present profits of the sale of the "Annual Weather Tables" will be insignificant compared with the emoluments that the discoverer will receive. If Mr. Blake has a scientific method of weather prediction he should lose no time in presenting it in detail to the scientific men by whom its merits will be fairly judged, and in which way alone he can secure the rewards, money and medals sure to be awarded by kings and learned societies as due to so great a discovery. But in the absence of any such publication and its acceptance by other students of the weather, I earnestly call upon the farmers of Kansas to reconsider the grounds of their faith in these "Weather Tables," and rely upon their own enlightened energy and judgment to overcome the vicissitudes of seasons. A true knowledge of the climate of Kansas is being accumulated by the Kansas Weather Service, and everyone by taking simple observations may aid in its work. The relation of crops to climate is being studied by the agricultural colleges and experiment stations, and every farmer should read the publications of the State Board of Agriculture and of the Agricultural Department of the Government, in which the results of their valuable experiments are made accessible. It is in these directions that agriculturists may reasonably look to obtain a conquest over climate, rather than to the presumptuous predictions of professional prophets.